Three New Species of *Impatiens* (Balsaminaceae) from Western Himalaya, India

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ABSTRACT: Three new species of *Impatiens* (Balsaminaceae), viz., *I. badrinathii* Pusalkar & D.K. Singh, *I. leggei* Pusalkar & D.K. Singh and *I. devendrae* Pusalkar, are described and illustrated from the Western Himalaya, India.

KEY WORDS: *Impatiens*, *Balsaminaceae*, new species, Western Himalaya, India, Uttarakhand, Himachal Pradesh.

INTRODUCTION

The genus *Impatiens* L. (Balsaminaceae) is represented by ± 1000 species distributed in the tropical and north temperate regions of world, especially India, China and Africa, with few representatives in America and Europe (Mabberley, 2008). India, with 203 species, mainly concentrated in two "World Hotspots of Balsam Diversity", viz., the Himalaya and Western Ghats, has 138 taxa comprising 135 species and 3 varieties endemic to the country (Viveknanthan et al., 1997).

During recent study on the genus, popularly known as "Poor Man's Orchids" or "Jewel-weeds", in the Garhwal and Kumaon Himalaya, as a part of the "State Flora of Uttarakhand", the senior author collected a number of beautiful *Impatiens*. Subsequent detailed study of the fresh material, observations on the dried specimens in the herbarium of the Botanical Survey of India, Northern Circle, Dehradun (BSD), Forest Research Institute, Dehradun (DD) and Central National Herbarium (CAL), along with the consultation of relevant literature (Hooker, 1874, 1875, 1908; Nasir, 1980; Naithani, 1984; Pobedimova, 1986; Akiyama, 1987; Akiyama et al., 1991; Grey-Wilson, 1989, 1991; Hajra and Balodi, 1995; Viveknanthan et al., 1997; Yilin et al., 2007), revealed that a number of collections from various parts of the state and neighbouring Himachal Pradesh are referable to three distinct taxa, which were hitherto undescribed. These are hence described and illustrated here as new species, namely, *I. badrinathii* Pusalkar & D.K. Singh, *I. leggei* Pusalkar & D.K. Singh and *I. devendrae* Pusalkar. As per conspectus of the sections of the genus proposed by Hooker (1874), *I. badrinathii* belongs to the Series B, section B-I *Oppositifoliae* Hook.f. (Hooker, 1874, p. 441), *I. leggei* belongs to the Series B, section B-V *Racemosae* Hook.f. (Hooker, 1874, p. 442), whereas *I. devendrae* belongs to the Series B, section B-IV *Subumbellatae* Hook.f. (Hooker, 1874, p. 442). Photographs of the new taxa are provided for easy field identification and understanding of floral parts and colour patterns, which in *Impatiens*, are difficult and complicated to describe satisfactorily from dried herbarium specimens.

For SEM study on pollen grains and the seeds, dried pollen grains and seeds were fixed on double adhesive carbon tape affixed on aluminum stubs. The materials were then glow-discharge coated for three minutes by gold coating technique in BIO-RAD Polaron Division SEM Coating System and then scanned for micro structures at suitable magnifications, accelerating potential and resolution in Zeiss EVO 40 EP Scanning Electron Microscope [Carl Zeiss SMT Ltd., Cambridge, UK] at the Wadia Institute of Himalayan Geology, Dehradun.

TAXONOMIC TREATMENTS

Impatiens badrinathii Pusalkar & D.K. Singh, *sp. nov.*

Impatiens amplexicaulis sensu B.D. Naithani, Fl. Chamoli 1: 109. 1984; Hajra & Balodi, Pl. Wealth Nanda Devi Biosph. Res. 93. 1995; Viveknanthan et al., Fl. India 4: 117–118, *pro majore parte*, incl. fig. 36. 1997, non Edgew., 1846. Figs. 1 A-W, 4A, 6A & B

Impatiens amplexicaulis Edgew (Figs. 1X-Z). affinis, sed floribus brevibus, roseis vel roseis et albidis, minus quam 18 mm longis; lateralio-sepalis 2.3-4 x 1.6-3.5 mm; labiis navicularibus, roseo-albidis vel albidis, non punctatis in calcar plus minusve rectum laevigate contractis; calcari lateralio-sepalis longioribus; supero-petalis minus quam 15 mm latis differt.

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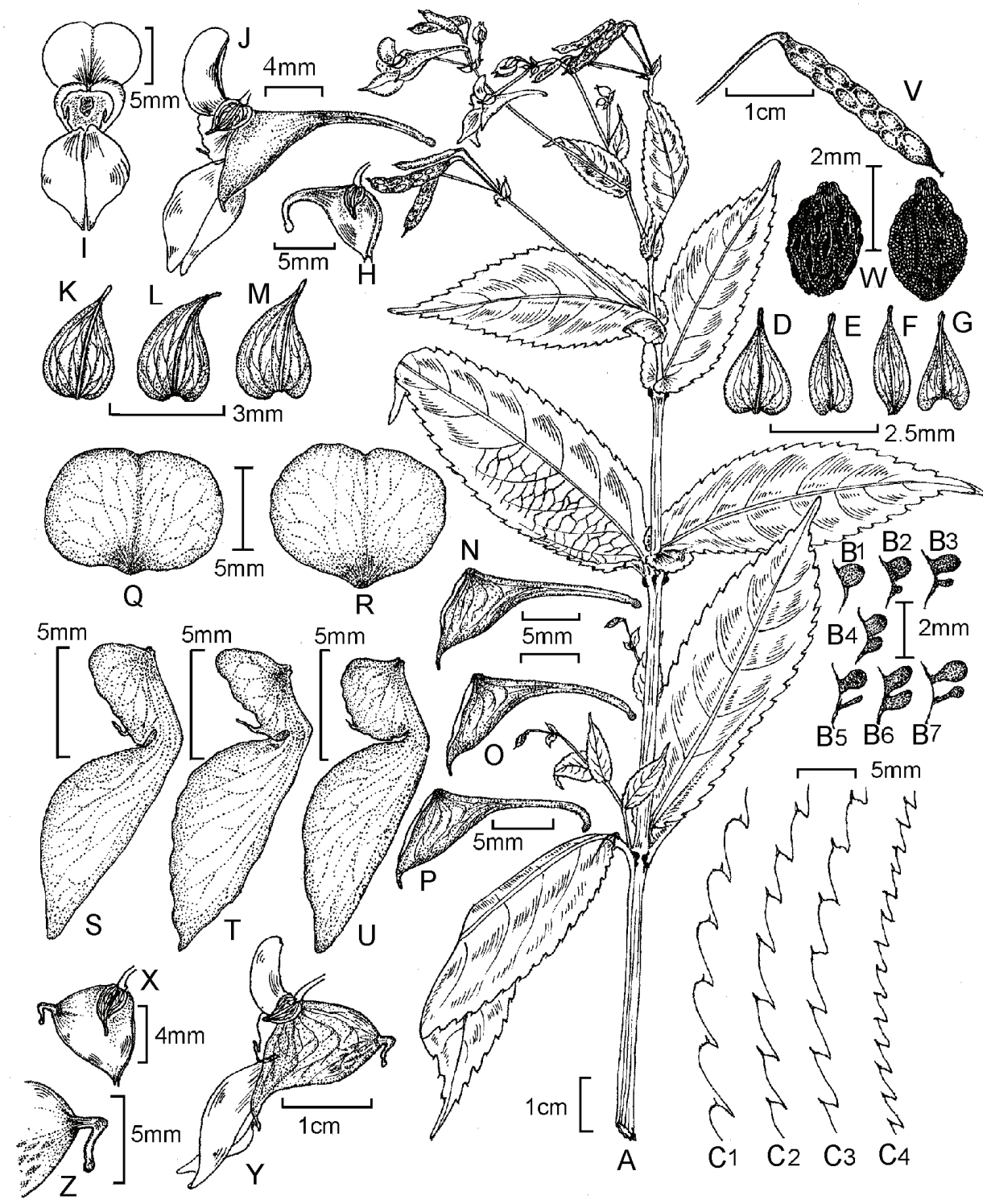


Fig. 1. ***Impatiens badrinathii*** **Pusalkar & D.K. Singh. A: Flowering twig. B1-B7: Leaf/petiole base gland(s). C1-C4: Leaf margin (variation); D, E, F, G: Bracteole (variation). H: Flower bud. I: Flower (front view). J: Flower (lateral view). K, L, M; Lateral sepal (variation). N, O, P: Lip with spur (variation). Q, R: Upper petal (variation). S, T, U: Wing/lateral fused petals (variation). V: Fruit. W: Seeds. X, Y, Z:** ***Impatiens amplexicaulis*** **Edgew. X: Flower bud. Y: Flower. Z: Spur. [A-W: drawn from the holotype, X, Y, Z: drawn from the holotype** ***M.P.Edgeworth*** **333 (Holo: K; cibachrome: BSD) by Prashant K. Pusalkar].**

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Type (here designated): India, Western Himalaya, Uttarakhand, Upper Alkananda valley, Mana–Vasudhara, 11/Aug./2008, *Pusalkar 111306* (*holotype et isotype*: BSD)

Annual, erect herb, 15–80 cm high; stem simple to moderately branched, glabrous, ribbed, with few scattered, brown, sessile or stipitate glands, particularly in the upper part of the stem. Lower and middle leaves opposite, petioled to sub sessile; petiole up to 1 cm long; lamina oblong to lanceolate or elliptic-lanceolate, sometimes oblong-spathulate, 5–20 x 0.8–8 cm, base rounded to amplexicaule with auricled lobes, apex acuminate to caudate, margins crenate, dentate, serrate- or crenate-dentate (same leaf with margins serrate or dentate in basal part, crenate-dentate in upper part) to serrate or serrulate (usually in upper leaves and foliaceous bracts) with cuspidate teeth; lower teeth often with gland-tipped cusps, surfaces glabrous; uppermost leaves and foliaceous bracts alternate, sessile, lanceolate or oblong-lanceolate, smaller than lower leaves, base amplexicaule, margins crenate-dentate to serrate or serrulate, cuspidate or glandular-cuspidate, apex acuminate, surfaces glabrous or sometimes with few glands, particularly on lower surface. Inflorescence peduncled, 2–8-flowered interrupted racemes arising from the axis of alternate, foliaceous bracts in the upper part of the stem; peduncle up to 15 cm long, glabrous, glandular, with small, brown stipitate and/or sessile glands; bracteoles ovate to cordate or ovate-lanceolate, 2–3.5 x 0.9–2.2 mm, apex acuminate, cuspidate or gland-tipped; pedicels slender, glabrous, with or without sparse, sessile or stipitate, brown glands; lower pedicels fascicled in pseudo-whorls, usually arising from close-set zones separated by non pedicel bearing long zones making raceme interrupted; upper flowers often arranged with regular spacing. Flowers pink and white or pink, white and yellow; lip (lower sepal) white, pinkish white or cream-coloured; spur white; upper petal pink, upper lateral petals (of fused pair of wing) white or pinkish-white, sometimes in basal part flushed with or spotted with yellow; lower lateral petals (of fused pair of wing) pink or pink with white base, often flushed with or spotted with yellow at the throat (fusion point of lateral petals/wing). Lateral sepals 2, opposite, one on either side, ovate to cordate, 2.3–4 x 1.6–3.5 mm, base rounded or cordate, unequally parted, margins entire, apex acuminate, gland-tipped or not, surfaces glabrous with conspicuous vein network. Upper petal cucullate, sub orbicular to oblong, 6–10 x 8–15 mm, apex notched, margins entire or wavy, concave in the middle with spreading sides. Lip navicular, somewhat flattened on sides, 10–18 mm long (including spur), 8–12 mm deep at face, lip smoothly tapering into almost straight spur; ending into slightly swollen tip. Lateral petals (upper petal lobe of fused pair of wing) sub orbicular to oblong with caudate tip, concavely hooded within, not spreading outwards, 3–6.5 x 3–6.2 mm, margins sub entire or wavy. Lower petals (of fused pair of wing) ovate to obovate, spreading, 8–12 x 4–10 mm, usually not lobed, margins (outer and inner) entire or wavy. Stamens 5; filaments 2–3.5 mm long, flattened, membranous, partly united upwards; anthers 0.8–1.5 mm long, partly fused; pollen grains bilateral, amb ± rectangular, 16.6 x 33.3 µm, brevicolpate with usually very small, furrow-like aperture; exine reticulate, heterobrochate with the lumina dotted with free, short columella. Ovary oblong-linear or oblong-elliptic, 2–3 mm long, glabrous; style 0.1–0.4 mm long; stigmas 5, minute. Capsules linear, 1–2.8 cm long, 0.2–0.5 mm broad, glabrous, green with purplish base and apex, 4–10-seeded; seeds black, oblong or sub ovoid, 2–3.6 x 1.5–2 mm, surface papillate with the papillae closely set, swollen, teat-like at tips, covered with secondary reticulations all over.

Flowering & Fruiting: July–October.

Habitats: Common, in open or partly shaded moist places, rock-shade, along streams and muddy places along water passage, between 2000–3650 m.

Conservation status: Least Concerned (lc).

Distribution: INDIA [Western Himalaya: Himachal Pradesh, Uttarakhand], NEPAL.

Specimens examined: INDIA: UTTARAKHAND:Garhwal Himalaya: Tihri Garhwal (now Uttarkashi) on route to Mandrola from Sukkhi, 1883, *J.F. Duthie 966* a (DD); British Garhwal, near Kuari pass, 3300–3640 m, 09/Sept./1883, *J.F. Duthie 3899* (DD); Chamoli, Ghagaria, 3000 m, 16/Aug./1963, *U.C. Bhattacharyya* 29426 (BSD); Chakrata, Deoban, 2000 m, 26/Jul./1970, *O.P. Misra 38142* (BSD); Chamoli, Jumma area, 2800 m, 14/Aug./1974 *B.D. Naithani 53882* (BSD); Chamoli, on way to Lata kharak, Sept. 1989, *P.K. Hajra 87446* (BSD); Chamoli, on way to Bampa, *B.D. Naithani 56037* (BSD); on way to Dunagiri, above Kaga, 3000 m, 18/Aug./1974, *B.D. Naithani 53928* (BSD); Tehri, Gangi, 3000 m, 10/Aug./1978, *A.K. Goel 64324* (BSD); Chamoli, Nanda Devi–Dibrugheta, 29//Aug./1981, *P.K. Hajra 73414* (BSD); Chamoli, Belta–Lata kharak, 27/Aug./1989, *P.K. Hajra 87790* (BSD); Chamoli, Belta, 27/Aug./1989, *P.K. Hajra*, *87271* (BSD); Uttarkashi, above Yamnotri, 05/Oct./1993, *S.C. Majumdar* & *S. Singh 88043* (BSD); Uttarkashi, Upper Bhagirathi valley, Gangotri National Park, Chirbasa-Bhojbasa, 3400–3500 m, 24/Jul./2003, *Pusalkar 104556* (BSD); Gangotri, 3200 m, 28/Jul./2003, *Pusalkar 104595* (BSD); Yamuna valley, Hanumanchatti-Krishnachatti, 2400–2500 m, 07/Aug./2007, *Pusalkar 110083* (BSD). Kumaon Himalaya: Kali valley, Girgaon, 13/Sept./1900, *Inayat 23994* (DD); Gori valley, Tola, 15/Aug./1900, *Inayat 24003* (DD); Kumaon, *Inayat 5562* (DD); Pithoragarh, Dugtu, 08/Aug./1998, *B.P. Uniyal* & *B. Balodi 93946* (BSD); Pithoragarh, Baling, 17/Aug./1998, *B.P. Uniyal* & *Bipin Balodi 94237* (BSD). HIMACHAL PRADESH: Simla hills, *J.R. Drummond 1124*/ DD Acc. No. 34510 (DD). NEPAL: above Budhi village, 22/Jul./1896, *J.F. Duthie 5410* (DD).

Etymology: The species is named after the Lord Badrinath, as the type locality is near the Shrine, which is known as one of the four holiest places (Dhams) in Indian Himalayan state of Uttarakhand.

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Comments on allied species: This species, one of the most common species of the western Himalayan *Impatiens*, has so far remained misidentified due to the fact that it shares the most important diagnostic character of amplexicaule upper leaves and bracts with *I. amplexicaulis* Edgew. As this character of amplexicaule leaf/bract base is always used as a exclusive key character to distinguish the latter species, other floral characters remained ignored and hence the taxon under consideration remained unnoticed under *I. amplexicaulis*. Though, the flowers of *Impatiens* are very delicate and the details are often very difficult to observe in dried herbarium material, characters used here are easy to observe and use as diagnostic characters. Moreover, it differs in the shape of lip, which in Balsams is the qualitative diagnostic character of high value. Study of the holotype of *I. amplexicaule* [Himalaya, Simla, 17000 ped., M.P.Edgeworth 333 (holotype: K; Cibachrome: BSD)] revealed that J.D. Hooker (*l.c.*) was very correct in treating *I. amplexicaulis* with *I. gigantea* Edgew. (= *I. sulcata* Wall.) and *I. roylei* Walp. (= *I. glandulifera* Royle), as the robust flowers of these three species are large (2 cm or more long and deep), more or less the same size and elongated helmet-shaped bucciniform lip abruptly constricted into a short, angled, hooked spur (Edgeworth, in protologue of *I. amplexicaulis*.) are exactly similar. In newly described *I. badrinathii* flowers are smaller in size, less than 18 mm long and deep; lateral sepals small, 2.3–4 x 1.6–3.5 mm; upper petal less than 15 mm broad; flowers pink and white or pink, white and yellow; lip navicular, white, smoothly tapering into a slender, almost straight spur, which is longer than lateral sepals. In allied *I. amplexicaulis* flowers are robust, more than 2 cm long and deep; lateral sepals 5–6 x 5–6.5 mm, purple or rosy pink; lip helmet-shaped, bucciniform, pinkish, often purple-spotted, abruptly constricted into a small, angled, hooked spur, which is shorter than lateral sepals.

It is also important to note that the novelty, which is common in the Western Himalaya from Himachal Pradesh (India) eastward up to Nepal has a larger distribution range than *I. amplexicaulis*. Smaller size of flowers, with navicular lip, smoothly tapering into almost straight spur of *I. badrinathii* is easily observable, even in dried herbarium material. In flower bud stage, two taxa can be separated by the comparative size of spur and lateral sepals. In *I. amplexicaulis* buds, short hooked spur is shorter than lateral sepals whereas, in buds of *I. badrinathii*, spur is longer than lateral sepals. Study of the fruiting specimens showed that capsules are purplish in *I. amplexicaulis* and green or green with purplish base and tips in *I. badrinathii*.

Note: The illustration in Flora of India (Viveknanthan et al., 1997, p. 118, Fig. 36) is of the present taxon and not of the true *I. amplexicaulis*.

Impatiens leggei Pusalkar & D.K. Singh, *sp. nov.*
Fig. 2, 4B, 6C & D

Folia alternata, elliptica, oblonga ad lanceolata, margine crenata, cuspidata, cuspis basalis; petiolus base non biglandulifer; flores albidi, rosei vel lavenduli et lutei, 4–18 – aggregati, in racemos axillares ad culmo-apicem; vexillum dorsalifer ad basim biglanduliferum; labium naviculare, in calcar plus minusve rectum vel apice curvatum contractum; capsulae lineares vel linearo-subclavatae, nodosae, ad angulos pallidae; semina oblonga.

Type (here designated): India, Western Himalaya, Uttarakhand, Chamoli district, Nanda Devi Biosphere Reserve, Ghangaria, near Valley of Flowers National Park entrance, ± 3100 m, 08/Aug./2008, *Pusalkar 111142* (*holotype et isotype*: BSD).

Annual, erect herb, 15–70 cm high; stem simple to moderately branched, glabrous or glandular, with few scattered, small, rounded, brown sessile glands, particularly in the upper part of the stem. Leaves alternate below, aggregated in the upper part of the stem, petioled below, almost sessile or sub sessile above; petiole up to 4 cm long, glabrous, petiole base without pulvinate glands; lamina lanceolate to oblong or elliptic, 4–18 x 2–7.2 cm, base attenuated, apex acuminate, margins crenate-cuspidate with basal or sometimes sub basal cusps, surfaces glabrous, with or without embedded raphides; leaf margins with basal crenatures showing sessile or stipitate glands, becoming glandular-cuspidate and finally cuspidate in upper crenatures. Inflorescence of axillary racemes, aggregated in the axils of the upper clustered leaves, usually exceeding the foliage, peduncled; inflorescence axis (including peduncle) 2–18 cm long, glabrous or with sparse, sessile, brown glands; bracteoles ovate to lanceolate or elliptic, acuminate, usually gland-tipped, 1.5–3.8 x 1–2.6 mm, glabrous; pedicels slender, curved at tip. Flowers 4–18 per raceme, white, pink and yellow or white, lavender and yellow; lateral sepals greenish or yellowish-creamy; lip (lower sepal) white or flushed with yellow or with yellow irregular spots or streaks within (which appears pale from without); spur white or purple-tipped white; upper petal white; wings on either side of fusion point flushed with yellow or orange-yellow at the base or with yellow or orange spots; upper lateral petals (of fused pair of wings) white or pinkish-white, lower petals pink or lavender, often white at base. Lateral sepals 2 (one pair of opposite sepals), ovate to lanceolate, unequally parted by midvein, sometimes somewhat curved, 2.5–5 x 1.2–4.5 mm, margins entire,

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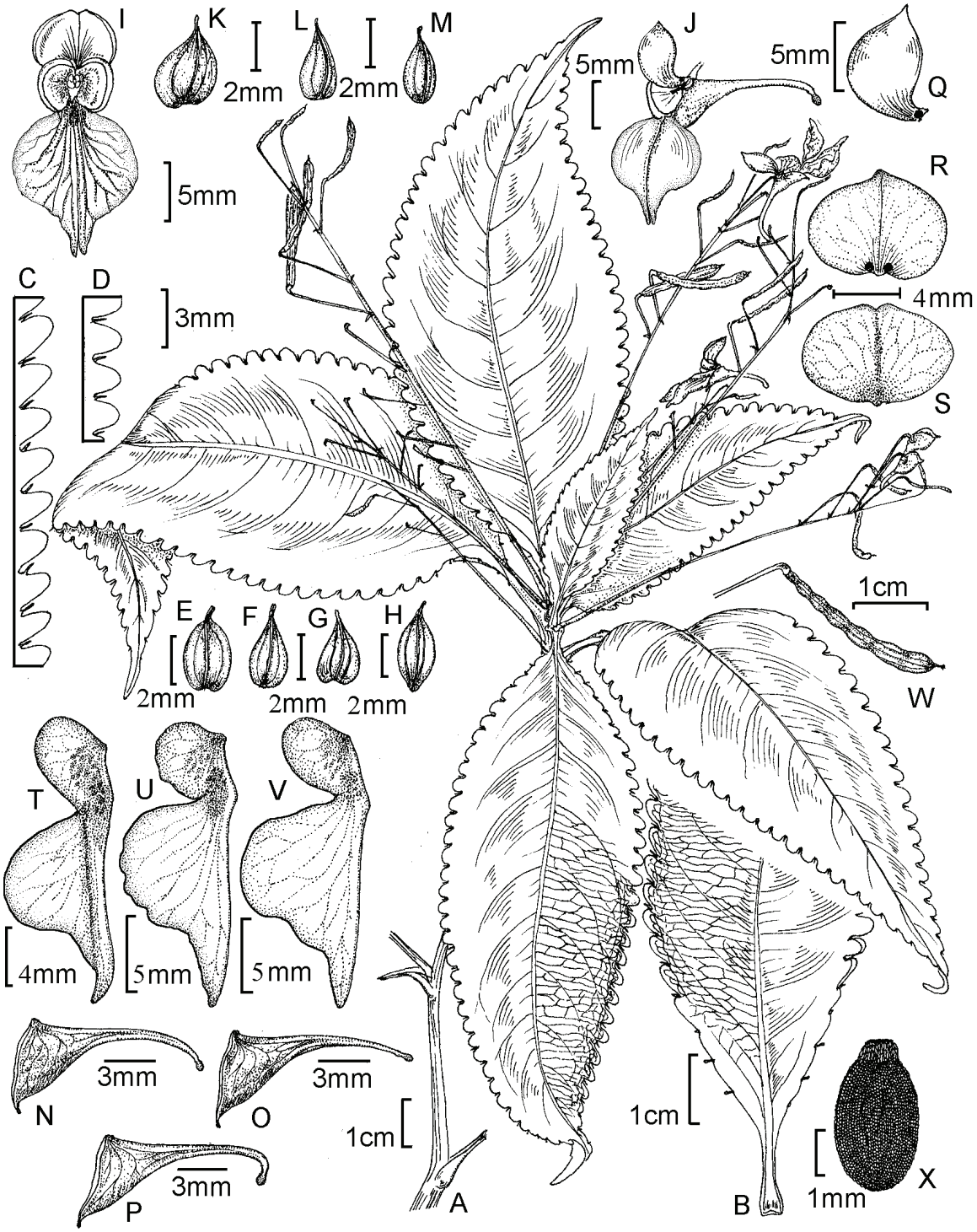


Fig. 2. ***Impatiens leggei*** **Pusalkar & D.K. Singh. A: Flowering twig. B: Leaf base (showing glandular cusps in basal crenatures). C, D: Leaf margin showing basal cusps (variation). E, F, G, H: Bracteole (variation). I: Flower (front view). J: Flower (lateral view). K, L, M: Lateral sepal (variation). N, O, P: Lip with spur (variation). Q: Upper petal (lateral view). R: Upper petal (back view showing pair of glands). S: Upper petal (front view). T, U, V: Wing/lateral fused petals (variation). W: Fruit. X: Seed. [drawn from the holotype by Prashant K. Pusalkar].**

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apex acuminate, gland-tipped or not, surfaces glabrous; lip navicular, 10–18 mm long (including spur), 5.2–8 mm deep at face, with 0.3–0.5 mm long acuminate or cuspidate lower tip and smoothly tapering into long, straight or terminally slightly curved spur. Upper petal cucullate, suborbicular to oblong-orbicular, 5–10 x 5.8–12 mm, apex notched, back keeled, concavo-convex in the middle with spreading sides, base on the outer side (at pedicel attachment point) with a pair of rounded sessile glands, one on either side of midvein. Wings (fused lateral and lower petals) in pair, 12–25 mm long. Upper lateral petals (of fused pair of wing) sub orbicular to oblong, 3–8.2 x 3.7–7.8 mm, concavely hooded inside, not spreading outwards, margins entire or wavy. Lower petals (of fused pair of wing) usually dolabriform, 8–15 x 3.8–10.2 mm, lobed or rarely ovate, entire, not lobed; lower lobe (if lower petal lobed/dolabriform) very small, 2–4.5 x 1.3–2 mm, caudate or as linear appendix. Stamens 5; filaments 2–3.5 mm long, partly fused above, tapering below; anthers 1.5–2 mm long, partly fused; pollen grains bilateral, amb rectangular, 22.2 x 33.3 µm, brevicolpate on the four corners; exine reticulate, heterobrochate with the lumina dotted with rod-like ornamentations. Ovary linear-elliptic to oblong, 2–3 mm long, glabrous; style 0.1–0.4 mm long; stigmas 5, minute, sessile. Capsules linear or linear-subclavate, 1.7–3.4 cm long, 1.2–2.4 mm broad, straight or curved, glabrous, green, often purple at base and tip, angles green or pale cream-coloured (not purple), 5–12-seeded; seeds black, oblong, 1.8–3.9 x 0.5–2.5 mm long, surface reticulate with the lumina ± rhomboidal, more or less heterobrochate, ridges fine, > 0.5 µm thick, with minute granular processes.

Flowering & Fruiting: July–October.

Habitats: Common, in partly shaded or open moist places and rock-shade, between 2400–3450 m.

Conservation status: Least Concerned (lc).

Distribution: India (Western Himalaya: Himachal Pradesh, Uttarakhand), probably Endemic.

Specimens Examined: India, Western Himalaya, HIMACHAL PRADESH: Kothi, 2700 m, 31/Aug./1961, *N.C. Nair 16418* (BSD); UTTARAKHAND: Garhwal Himalaya: Chamoli, Nanda Devi Biosphere Reserve, Ghagaria, 3000 m, 16/Aug./1963, *U.C. Bhattacharyya 29427* (BSD); Nanda Devi Biosphere Reserve, on way to Dibrugheta, 29/Aug./1981, *P.K. Hajra 73414 A* (BSD); Chamoli, Sutol–Talkapa, 09/Sept./1989, *P.K. Hajra 87914* (BSD); Uttarkashi, on way to Hadala, Sept. 2000, *Bipin Balodi 96405* (BSD); Uttarkashi, Raithal forest, on way to Dayara Bugyal, 2500–2700 m, 20/Aug./2007, *Pusalkar 119947* (BSD). Kumaon Himalaya: Pithoragarh, Rungling Forests, 2800–3800 m, 08/Oct./1975, *C.M. Arora 56768* (BSD).

Etymology: This species, which was collected near the Valley of Flowers, is named as a tribute to late Miss J. Margarete Legge, a Botanist deputed by the Royal Botanic Gardens, Edinburgh in 1939 for botanical exploration in the Valley of Flowers. During plant collection, she slipped from a rocky slope and died in the valley. A small and thoughtful memorial erected in the beautiful riverside meadow, where her dead body was buried, reminds the dedication and courage of the late botanist and inspires every nature lover visiting the valley.

Comments on allied species: *Impatiens leggei* is allied to *I. balfourii* Hook.f. group (comprising *I. balfourii* Hook.f., *I. flemingii* Hook.f. and *I. meeboldii* Hook.f.), but differs from all these species in having leaf margins crenate, cuspidate with basal cusps, petiole base without pulvinate glands, flowers white, pink or lavender and yellow, upper petal base or pedicel apex on outer side with a pair of glands at the base (towards pedicel tip), lower petals (of fused pair of wing) usually dolabriform, lobed, rarely not lobed, ovate, capsules nodding, pale on angles and seeds oblong. In *I. balfourii* (and related species of the group), leaf margins are dentate or serrate with marginal teeth showing terminal cusps, petiole bases with a pair of black or brownish-black conspicuous pulvinate glands, flowers white and pink or white and pink with yellow throat, upper petal base or pedicel apex without glands, capsules erect (in *I. balfourii*)/nodding (*I. flemingii/ I. meeboldii*), purple on angles and seeds ovoid or subovoid.

Impatiens devendrae Pusalkar, *sp. nov.* Figs. 3, 5, 6E & F

Affinis *Impatiens bicornutae* complex (*Impatiens bicornuatae* Wall., *I. harae* S. Akiyama, *I. pradhanii* Hara, *I. kaliensis* Grey-Wilson et *I. arunensis* Gery-Wilson affine), sed floribus albidis; labiis oblongo-bucciniformibus, apice rotundis, albidis intra purpureomaculatis vel purpureolineatis, extra pallidis, in calcar abrupte constrictis; calcari uncato, viridi; superopetalis carinatis, in intra centralio-cavitatem viridis et maculatis; carina dorse purpureomarronina; lateralio petalo (alae-petali) lobato, lobis oblongis ad triangularibus, lateralio-lobis non auriculiformibus, lateraliolobis inferolobis aequalibus vel marginioribus et inferolobis inferopetalorum non caudatis differt.

Type (here designated): India, Western Himlaya, Uttarakhand, Chamoli district, Nanda Devi Biosphere Reserve, Alkananda valley, on way to Ghangria, 1 km behind Ghangaria towards Govindghat, 2900–3100 m, 06/Aug./2008, *Pusalkar 111017* (holotype et isotype: BSD).

Annual, erect herb, 30–80 cm tall; stem simple or sparsely branched, glabrous, with few scattered, rounded, brown sessile glands, particularly in the upper part of the stem. Leaves spirally arranged, alternate below, aggregated or apparently whorled at the top of the stem, petioled; petiole up to 4 cm long, glabrous; lamina oblong-ovate, lanceolate, oblong-elliptic or elliptic-oblanceolate, (4–)5–22 x 2.8–12 cm, base

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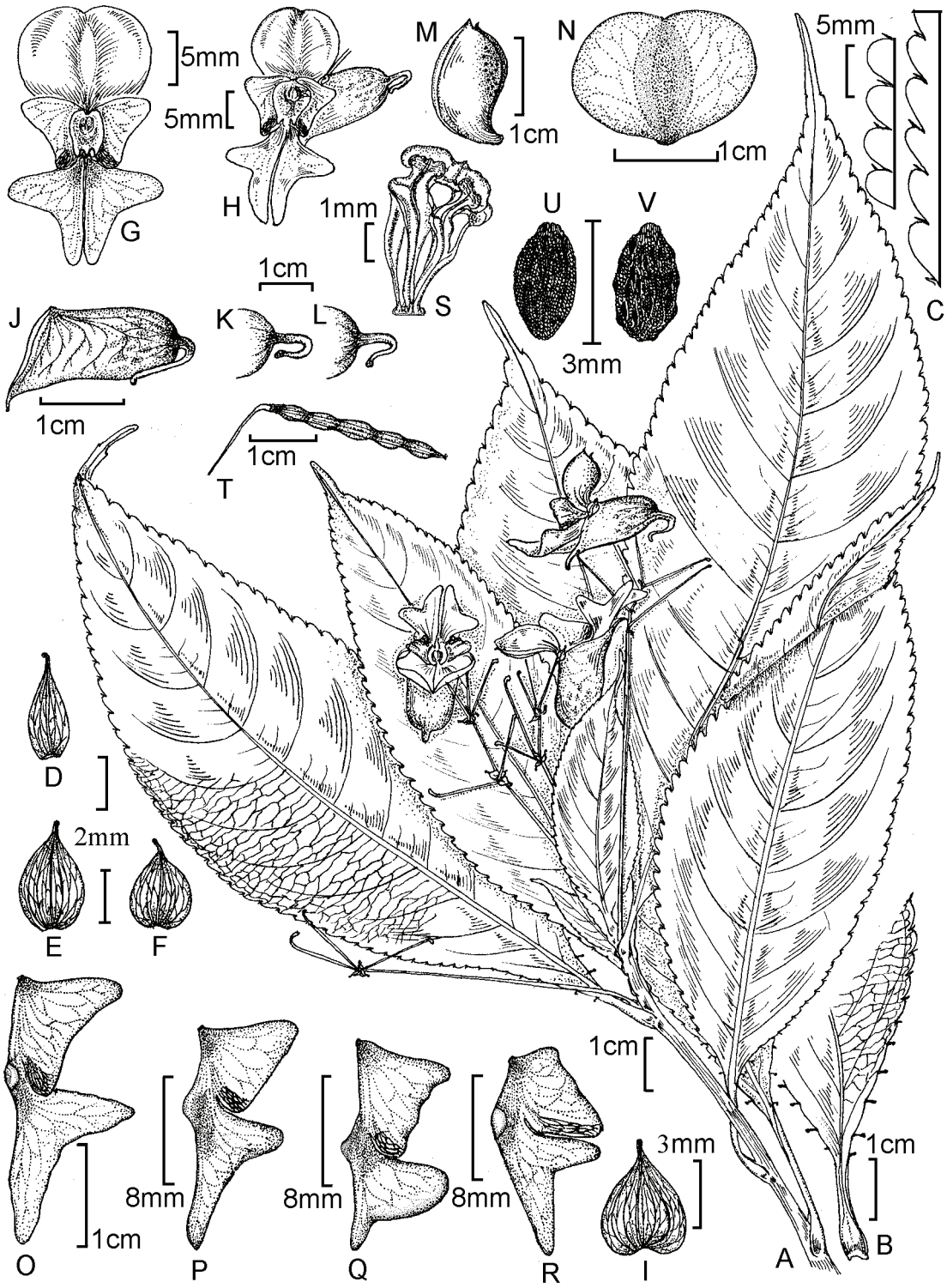


Fig. 3. ***Impatiens devendrae*** **Pusalkar. A: Flowering twig. B: Leaf base (showing marginal glandular cusps). C: Leaf margin showing basal cusps. D, E, F: Bracteole (variation). G: Flower (front view). H: Flower (oblique-lateral view). I: Lateral sepal. J: Lip with spur. K, L: Spur (variation). M: Upper petal (lateral view). N: Upper petal (front view). O, P, Q, R: Wing/lateral fused petals (variation). S: Stamen. T: Fruit. U, V: Seed.**

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attenuated, apex acuminate-caudate, margins crenate-dentate, cuspidate or glandular-cuspidate, surfaces glabrous or sparsely hairy, with or without embedded white raphides, sometimes with scattered glands on lower surface, especially on veins; cusps basal or sub basal, with 1–3 crenatures towards leaf base with sessile glands, followed by few crenatures with stipitate glands, tuning into glandular or simple cusps towards apical parts. Inflorescence of interrupted racemes, 10–20 cm long, arising from axiles of terminally aggregated cluster of leaves at the top of the stem, 4–17-flowered, lower pedicels fascicled into 2–4-flowered pseudo-whorls; peduncle 3–12 cm long, glabrous, with or without few scattered sessile glands; bracteoles ovate, ovate-cordate to lanceolate, 2.5–6 x 1.5–3.5 mm, apex acuminate, usually gland-tipped, sometimes not; lower racemes usually 1–few-flowered. Flowers white, 2.5–3.5 cm long, 2.5–3.2 deep at face; lateral sepals green or yellowish green, with purple mid-vein and tip; lip white, yellowish-white or greenish-yellow, with yellowish-orange and/or purple spots or streaks within, usually towards spurred end (which appears dull/pale from without), spur green, sometimes purple-tipped green; upper petal white with greenish central cavity, back keeled, with purplish-brown keel surrounded by green zone with purple spots; wings (comprising fused pair of upper and lower lateral petals) flushed or spotted with yellow or yellowish-orange at the middle (fusion point of lateral and lower petal) or at the base of the lower petals (of fused pair of wing); upper lateral petals (of fused pair of wing) white, with orange-, purple- or maroon-coloured close-set vein pattern towards the lower side; lower petals white or white, flushed with yellowish at the throat (fusion point with upper lateral petal). Lateral sepals 2 (one pair of opposite sepals), ovate, ovate-lanceolate to cordate, 3.8–6 x 2.5–3.5 mm, unequally parted by midvein, often somewhat curved, apex acuminate, usually gland-tipped, midvein prominently raised. Lip oblong-bucciniform, 15–22 mm long (excluding spur), 8–12 mm deep in middle of the lip, lower tip acuminate, gland-tipped or not, lip apex (at spur base) rounded, abruptly constricted into spur; spur green, narrowed, hooked, 8–15 mm long with slightly bulging tip directed inwards horizontally or downwards. Upper petal cucullate, oblong or sub orbicular-oblong in outline, 9.6–16.4 x 15–22 mm, keeled on back with keel terminating into small pointed outwardly projecting tip at the base of notched apex, but without prominent crest, margins entire to slightly wavy, usually spreading backwards (at maturity). Wings (fused lateral and lower petals) in pair, 15–28 mm long. Upper pair of lateral petals (of fused pair of wings) somewhat triangular in outline, 6–15 x 8–15 mm, spreading. Lower lateral petals (of fused pair of wing) lobed with spreading lobes, 10–20 mm long; lobes triangular to elongated oblong-triangular, sometimes oblong, 2.8–16.2 x 1.7–8.3 mm, lateral lobes larger, equal or smaller than lower lobes, margins entire or wavy. Stamens 5, typical of the genus; filaments 3–4.5 mm long, membranous, tapering below, partly fused above; connective with white, scale-like or wrinkled ornamentation; anthers 1.3–2 mm long, partly united; pollen grains large, bilateral, amb ± rectangular, 26 x 61 µm, brevicolpate, colpus-4; exine reticulate, heterobrochate with the lumina ornamented with dotted rods. Ovary linear-oblong or oblong-elliptic, glabrous, 2–3 x 0.6–1.4 mm. Fruits linear or linear-sub clavate, 2–3.8 cm long, 1.7–3.2 mm broad, glabrous, green, angles pale (not purple), 4–10-seeded; seeds black, brownish- or grayish-black, oblong, 2.5–4 x 1.4–2.8 mm, surface with naviculate processes; naviculae ± 7.0 x 3.5 µm, more or less uniform in size with verrucate processes on its outer surface and at the base / internavicular speces.

Flowering & Fruiting: July–September.

Habitats: Shaded or partly shaded, moist places in *Rhododendron* [*R. arboreum* (Ericaceae)] forests and along forest edges.

Altitude range: 2400–3200 m.

Abundance: Probably rare (locally common in the type localities, but restricted in distribution).

Conservation status: VULNERABLE due to restricted distribution.

Conservation measure(s): The type locality (Nanda Devi Biosphere Reserve) is within the Protected Area Network (PAN) of India.

Distribution: India (Western Himalaya: Uttarakhand), probably endemic.

Specimens examined: India, Western Himalaya, Uttarakhand, Govindghat–Ghangaria, 2900–3100 m, Aug. 1963, *U.C. Bhattacharyya 29425* (BSD); Bhyunder valley, *B.M. Wadhwa s.n.* (BSD); Uttarkashi, Raithal forest, on way to Dayara Bugyal, 2500–2700 m, 20/Aug./2007, *Pusalkar 119939* (BSD); Alkananda valley, Ghangaria–Govindghat, 1.5–2 km behind Upper Bhyundar village towards Ghangaria, 2600–2800 m, 06/Aug./2008, *Pusalkar 111125* (BSD).

Etymology: The species is named as a token of respect to the teacher of the senior author and the Additional Director of the Botanical Survey of India, Dr. Devendra K. Singh.

Comments on allied species: *I. devendrae* is allied to *I. bicornuta* complex (comprising *I. bicornuta* Wall., *I. harae* S. Akiyama, *I. pradhanii* Hara, *I kaliensis* Grey-Wilson and *I. arunensis* Grey-Wilson), and shows similar habit, habitats, foliage and inflorescence, but differs from all the allied species in the complex in the presence of white flowers, oblong-bucciniform lip with rounded tip at spurred end, abruptly constricted into a

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Fig. 4. A: Habit of *Impatiens badrinathii* Pusalkar & D.K. Singh. B: Habit of *Impatiens leggei* Pusalkar & D.K. Singh. (inset close-up of the flower in side view showing lip and spur).

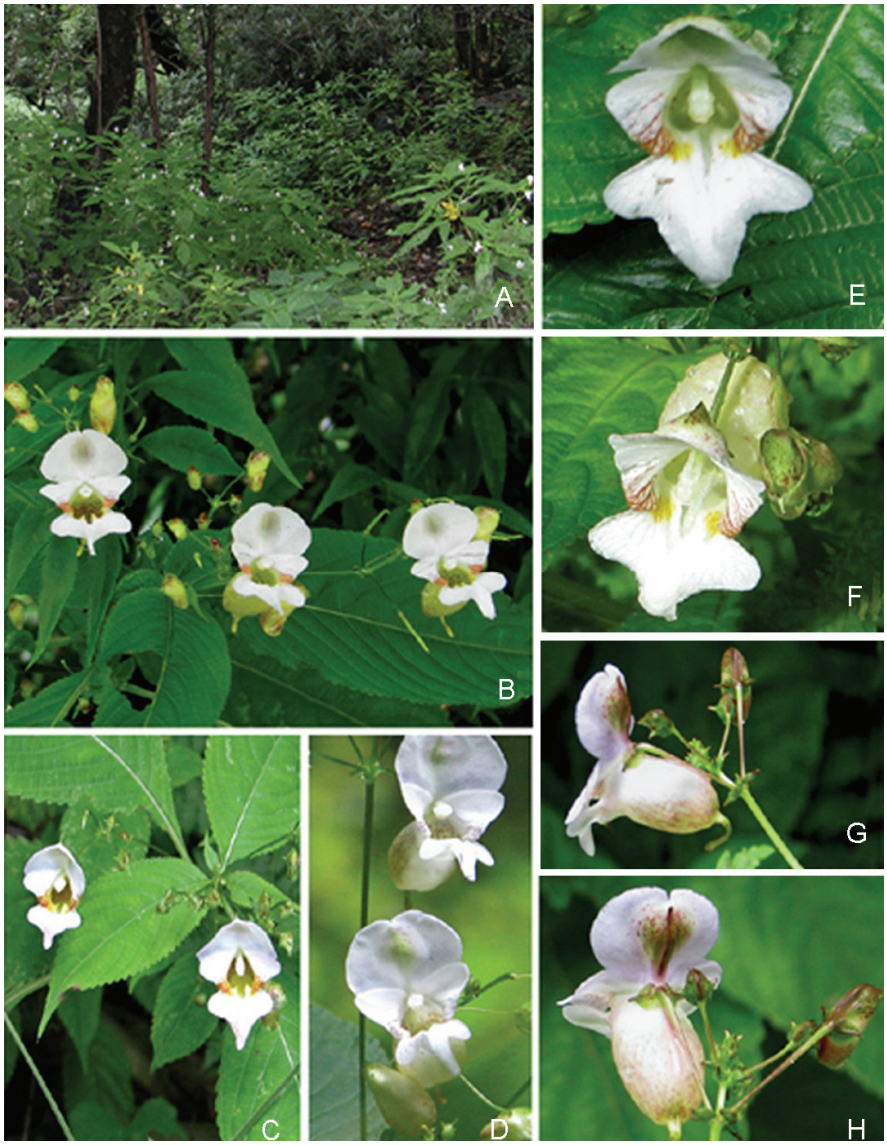


Fig. 5. *Impatiens devendrae* Pusalkar. A: Habitat, B–D: Inflorescence with flowers in front view showing variations in lower petal lobes and colour of narrowed lower side of lateral petals, E: A close-up of the flower in front view. F: A flower in top view. G: A flower in side view showing lip and spur. H: A flower in back view showing pedicel attachment.

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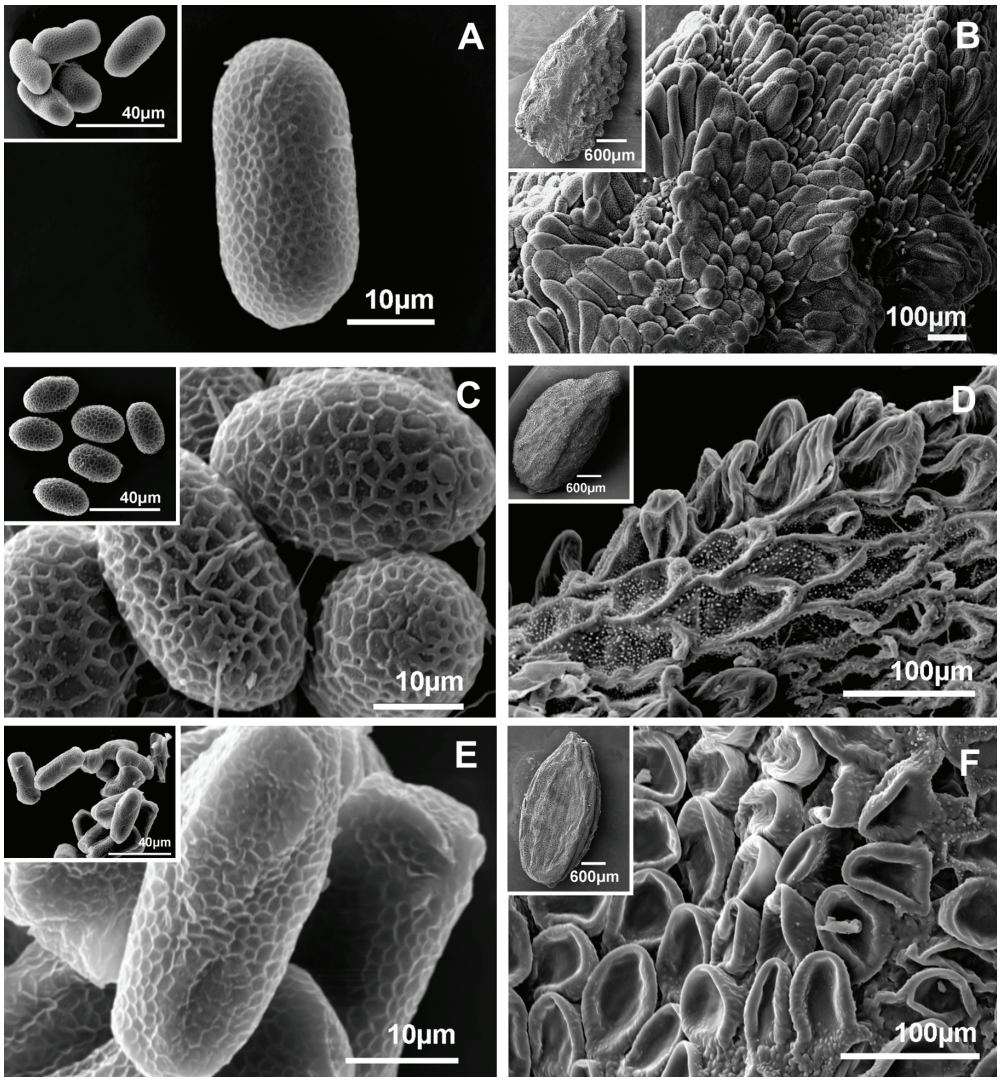


Fig. 6. Scanning Electron Microphotographs. A, B: *Impatiens badrinathii* Pusalkar & D.K. Singh. A: Pollen grain (inset: pollen grains in low magnification). B: Seed surface (inset: A seed). C, D: *Impatiens leggei* Pusalkar & D.K. Singh. C: Pollen grain (inset: pollen grains in low magnification). D: Seed surface (inset: A seed). E, F: *Impatiens devendrae* Pusalkar. E: Pollen grain (inset: pollen grains int low magnification). F: Seed surface (inset: A seed).

hooked, green spur, lip white with yellowish-orange and/or purple spots or purple streaks within, which appears pale from outside, upper petal keeled with keel purplish-maroon on back, central cavity surrounding keel is green and spotted with purple on outer face, upper lateral petals (of fused pair of wings) somewhat triangular in outline with orange-, maroon- or purple-coloured close-set vein pattern on lower narrowed side, lower petals (of fused pair of wing) lobed with oblong or oblong-triangular lobes, lateral lobes of lower petals not auricle-like, usually as long as or larger than lower lobes and lower lobes of lower petals not caudate.

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印度喜馬拉雅山西部地區新種鳳仙花屬 (鳳仙花科) 植物

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摘要：本文發表印度喜馬拉雅山西部地區三新種鳳仙花屬植物。在描述時每一新種均附有手繪圖、照片及其與近緣種之比較註解。

關鍵詞：印度、烏塔拉坎德邦、喜馬拉雅山西部地區、喜馬偕爾邦、新種、鳳仙花科、鳳仙花屬。

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